a second variation processor coupled to receive the exponents of said first set and determine a second variation between consecutive exponent values within said first set; and

A2

a neural network processor coupled to receive said first and second variations and select and assign an exponent coding strategy to said first set from a plurality of coding strategies on the basis of said first and second variations, wherein each of the plurality of coding strategies correspond to a different differential coding limit.

REMARKS

Applicants respectfully request that the foregoing preliminary amendment be entered in order to place the above-referenced application in better condition for examination and allowance.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current preliminary amendment. The attached page is captioned "**Version With Markings to Show Changes Made**."

Respectfully submitted,

Mohammed J. Absar et al.

Seed Intellectual Property Law Group PLLC

E. Russell Tarleton

E. Russell Tarleton
Registration No. 31,800

ERT:aep

Enclosures:
Postcard

701 Fifth Avenue, Suite 6300
Seattle, Washington 98104-7092
Phone: (206) 622-4900
Fax: (206) 682-6031

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims:

Claims 1-40 have been amended as follows:

1. (Amended) A method for processing data in an audio data encoder, the data ~~comprising~~ including a sequence of exponent sets each comprising a plurality of exponents, the method comprising the steps of:

determining a first variation of exponent values within a first exponent set;

determining a second variation of exponent values between said first exponent set and each subsequent exponent set in said sequence; and

assigning an exponent coding strategy to the first exponent set based on the determined first and second variations.

2. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 1, wherein the exponent coding strategy is assigned from a plurality of exponent coding strategies having different differential coding limits.

3. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 2, ~~including~~ comprising a step of coding said first exponent set according to the assigned exponent coding strategy.

4. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 3, ~~including~~ comprising a step of assigning an exponent coding ~~strategies~~ strategy to at least one subsequent exponent set based on the corresponding determined second variation.

5. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 4, wherein the plurality of exponent coding strategies includes an exponent set re-use strategy ~~which~~ that is assigned to the at least one subsequent exponent set.

6. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 5, ~~including~~ comprising a step of coding said first exponent set and said at least one subsequent exponent set according to the corresponding assigned coding strategies.

7. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 2 ~~or 6~~, wherein the steps of determining the first and second variations are performed ~~utilising~~ utilizing neural network processing.

8. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 7, wherein the neural network processing includes first and second neural layers.

9. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 7, wherein the neural network processing comprises a feature extraction stage in which said sequence of exponent sets is ~~utilised~~ utilized to determine said second variations, a weighted routing stage in which said second variations are weighted according to predetermined weighting values and routed to inputs of a first neural layer, a selection stage in which an output of the first neural layer is selected, and an output processing stage in which a coding strategy is assigned to said first exponent set based on said first variation and the output of said selection stage.

10. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 9, wherein a coding strategy is assigned to at least one subsequent exponent set on the basis of the output of said selection stage.

11. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 10, wherein the coding strategy assigned to the at least one subsequent exponent set is an exponent re-use strategy.

12. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 9, wherein the feature extraction stage comprises determining

$$\mathrm{Adiff}(E_i, E_j) = (\Sigma_m |e_{i,m} - e_{j,m}|)/n$$

where Adiff is said second variation,

E_i is said first exponent set and E_j is a subsequent exponent set with $j > i$,

$E_i = (e_{i,0}, e_{i,1}, e_{i,2}, \ldots, e_{i,n-1})$,

$E_j = (e_{j,0}, e_{j,1}, e_{j,2}, \ldots, e_{j,n-1})$,

n is an integer representing the number of exponents in a said set of exponents, and

$m = 0, 1, 2, \ldots, n-1$.

13. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 12, wherein the processing carried out by the weighted routing stage and first neural layer includes determining

$$Y = \begin{bmatrix} y_0 \\ y_1 \\ y_2 \\ \ldots \\ \ldots \\ y_{b-1} \end{bmatrix} = \Gamma(\begin{bmatrix} 0 & 0 & 0 & \ldots & \ldots & 0 \\ 0 & w_{1,1} & 0 & \ldots & \ldots & 0 \\ 0 & w_{2,1} & w_{2,2} & \ldots & \ldots & 0 \\ \ldots & \ldots & \ldots & \ldots & \ldots & 0 \\ \ldots & \ldots & \ldots & \ldots & \ldots & 0 \\ 0 & w_{b-1,1} & w_{b-1,2} & \ldots & \ldots & w_{b-1,b-1} \end{bmatrix} \begin{bmatrix} 0 \\ z_1 \\ z_2 \\ \ldots \\ \ldots \\ z_{b-1} \end{bmatrix} = \begin{bmatrix} 0 \\ T_1 \\ T_2 \\ \ldots \\ \ldots \\ T_{b-1} \end{bmatrix})$$

the operator $\Gamma[\bullet]$ is defined as:

$$\Gamma \begin{bmatrix} \gamma_0 \\ \gamma_1 \\ \gamma_2 \\ \ldots \\ \ldots \\ \gamma_{b-1} \end{bmatrix} = \begin{bmatrix} f(\gamma_0) \\ f(\gamma_1) \\ f(\gamma_2) \\ \ldots \\ \ldots \\ f(\gamma_{b-1}) \end{bmatrix}$$

where $f(\gamma_i)$ is +1 if $\gamma \geq 0$ else it is 0,

Y represents outputs of the first neural layer,

T are threshold values determined during a training phase,

w are weighting values determined during the training phase, and

b is the number of exponent sets in the sequence comprising said data.

14. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 13, wherein the selection stage comprises selecting an output y_a of the first neural layer such that $y_a = 1$ and a is maximum for $i < a < b$.

15. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 14, wherein the plurality of exponent coding strategies comprises strategies $S_1, S_2, \ldots, S_c$, where $c \leq b$, corresponding to differential coding limits 1, 2, … ,c.

16. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 15, wherein the exponent coding strategy S_γ assigned to said first exponent set E_i is selected according to

$$\gamma = \max[\min(a+1, \sigma(E_i)), 1]$$

where $$\sigma(E_i) = floor((\Sigma_j \| e_{i,j+1} - e_{i,j} \| / n) + 0.5).$$

17. (Amended) A method for coding audio data ~~comprising~~ having a sequence of exponent sets each comprising a plurality of exponents, the method comprising the steps of:

determining a first variation of exponent values between a first exponent set in the sequence and each subsequent exponent set in said sequence;

selecting an exponent coding strategy for said first exponent set from a plurality of exponent coding strategies on the basis of said first variation; and

coding said first exponent set according to the selected exponent coding strategy.

18. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 17, wherein each of the plurality of exponent coding strategies corresponds to a different differential coding limit.

19. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 17, ~~including~~ comprising selecting one of said subsequent exponent sets on the basis of said first variation and assigning an exponent re-use coding strategy to the selected exponent set and any exponent sets in said sequence between the first exponent set and the selected exponent set.

20. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 17, ~~18 or 19, including~~ comprising a step of determining a second variation between consecutive exponents in said first exponent set, wherein the exponent coding strategy for said first exponent set is selected on the basis of said first and second variations.

21. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 17, wherein the step of selecting the exponent coding strategy for said first exponent set is performed ~~utilising~~ utilizing neural network processing.

22. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 20, wherein the step of selecting the exponent coding strategy for said first exponent set is performed ~~utilising~~ utilizing neural network processing.

23. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 22, wherein the neural network processing comprises a feature extraction stage in which said sequence of exponent sets is processed to determine said first variation values, a weighted routing stage in which said first variation values are weighted according to predetermined weighting values and routed to inputs of a first neural layer, a selection stage in which an output of the first neural layer is selected, and an output processing stage in which a coding strategy is assigned to said first exponent set based on the output of said selection stage and said second variation.

24. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 23, wherein a coding strategy is assigned to at least one subsequent exponent set on the basis of the output of said selection stage.

25. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 24, wherein the coding strategy assigned to the at least one subsequent exponent set is an exponent re-use strategy.

26. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 23, wherein the feature extraction stage comprises determining the first variation values according to

$$Adiff(E_i, E_j) = (\Sigma_m |e_{i,m} - e_{j,m}|)/n$$

where Adiff is said first variation,

E_i is said first exponent set and E_j is a subsequent exponent set with $i > j$,

$E_i = (e_{i,0}, e_{i,1}, e_{i,2}, \ldots, e_{i,n-1})$,

$E_j = (e_{j,0}, e_{j,1}, e_{j,2}, \ldots, e_{j,n-1})$,

n is an integer representing the number of exponents in a said set of exponents, and

m = 0, 1, 2, …. , n-1.

27. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 26, wherein the processing carried out by the weighted routing stage and first neural layer includes determining

$$Y=\begin{bmatrix} y_0 \\ y_1 \\ y_2 \\ \cdots \\ \cdots \\ y_{b-1} \end{bmatrix} = \Gamma(\begin{bmatrix} 0 & 0 & 0 & \cdots & \cdots & 0 \\ 0 & w_{1,1} & 0 & \cdots & \cdots & 0 \\ 0 & w_{2,1} & w_{2,2} & \cdots & \cdots & 0 \\ \cdots & \cdots & \cdots & \cdots & \cdots & 0 \\ \cdots & \cdots & \cdots & \cdots & \cdots & 0 \\ 0 & w_{b-1,1} & w_{b-1,2} & \cdots & \cdots & w_{b-1,b-1} \end{bmatrix} \begin{bmatrix} 0 \\ z_1 \\ z_2 \\ \cdots \\ \cdots \\ z_{b-1} \end{bmatrix} = \begin{bmatrix} 0 \\ T_1 \\ T_2 \\ \cdots \\ \cdots \\ T_{b-1} \end{bmatrix})$$

the operator Γ[•] is defined as:

$$\Gamma\begin{bmatrix} \gamma_0 \\ \gamma_1 \\ \gamma_2 \\ \cdots \\ \cdots \\ \gamma_{b-1} \end{bmatrix} = \begin{bmatrix} f(\gamma_0) \\ f(\gamma_1) \\ f(\gamma_2) \\ \cdots \\ \cdots \\ f(\gamma_{b-1}) \end{bmatrix}$$

where $f(\gamma_i)$ is +1 if $\gamma \geq 0$ else it is 0,

Y represents outputs of the first neural layer,

T are threshold values determined during a training phase,

w are weighting values determined during the training phase, and

b is the number of exponent sets in the sequence.

28. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 27, wherein the selection stage comprises selecting an output y_a of the first neural layer such that $y_a = 1$ and a is maximum for $i < a < b$.

29. (Amended) ~~A~~The method ~~as claimed in~~ of claim 28, wherein the plurality of exponent coding strategies comprises strategies $S_1, S_2, \ldots, S_c$, where $c \leq b$, corresponding to respective differential coding limits 1, 2, ... ,c.

30. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 29, wherein the exponent coding strategy S_γ assigned to said first exponent set E_i is selected according to

$$\gamma = \max[\min(a+1,\sigma(E_i)),1]$$

where $\sigma(E_i) = floor((\Sigma_j \| e_{i,j+1} - e_{i,j} \| / n) + 0.5)$.

31. (Amended) A digital audio encoder in which audio data is transformed into coefficients having mantissas and exponents arranged in a sequence of sets, having:

a first variation processor coupled to receive the exponents of sets from said sequence and to determine a first variation of exponent values between a first set and a plurality of subsequent sets in the sequence;

a second variation processor coupled to receive the exponents of said first set and determine a second variation between consecutive exponent values within said first set; and

a neural network processor coupled to receive said first and second variations and to select and assign an exponent coding strategy to said first set from a plurality of coding strategies on the basis of said first and second variations.

32. (Amended) ~~An~~ The audio encoder ~~as claimed in~~ of claim 31, wherein each of the plurality of coding strategies correspond to a different differential coding limit.

33. (Amended) ~~An~~ The audio encoder ~~as claimed in~~ of claim 31 ~~or 32~~, wherein the neural network processor also selects and assigns an exponent coding strategy to at least one of the subsequent sets.

34. (Amended) ~~An~~ The audio encoder ~~as claimed in~~ of claim 33, wherein the exponent coding strategy assigned to the at least one subsequent sets is an exponent re-use strategy.

35. (Amended) ~~An~~ The audio encoder ~~as claimed in~~ of claim 31, wherein the neural network processor includes a weighted routing stage in which said first variation values are weighted according to predetermined weighting values and routed to inputs of a first neural layer, a selection stage in which an output of the first neural layer is selected, and an output processing stage in which a coding strategy is assigned to said first exponent set based on the output of said selection stage and said second variation.

36. (Amended) ~~An~~ The audio coder ~~as claimed in~~ of claim 35, wherein the first variation processor is arranged to determine said first variation according to

$$Adiff(E_i, E_j) = (\Sigma_m |e_{i,m} - e_{j,m}|)/n$$

where Adiff is said first variation,

E_i is said first exponent set and E_j is a subsequent exponent set with $i > j$,

$E_i = (e_{i,0}, e_{i,1}, e_{i,2}, \ldots, e_{i,n-1})$,

$E_j = (e_{j,0}, e_{j,1}, e_{j,2}, \ldots, e_{j,n-1})$,

n is an integer representing the number of exponents in a said set of exponents, and

$m = 0, 1, 2, \ldots, n-1$.

37. (Amended) ~~An~~ The audio coder ~~as claimed in~~ of claim 31 ~~or 36~~, wherein the weighted routing stage of the neural network processor is arranged to determine

$$Y = \begin{bmatrix} y_0 \\ y_1 \\ y_2 \\ \cdots \\ \cdots \\ y_{b-1} \end{bmatrix} = \Gamma(\begin{bmatrix} 0 & 0 & 0 & \cdots & \cdots & 0 \\ 0 & w_{1,1} & 0 & \cdots & \cdots & 0 \\ 0 & w_{2,1} & w_{2,2} & \cdots & \cdots & 0 \\ \cdots & \cdots & \cdots & \cdots & \cdots & 0 \\ \cdots & \cdots & \cdots & \cdots & \cdots & 0 \\ 0 & w_{b-1,1} & w_{b-1,2} & \cdots & \cdots & w_{b-1,b-1} \end{bmatrix} \begin{bmatrix} 0 \\ z_1 \\ z_2 \\ \cdots \\ \cdots \\ z_{b-1} \end{bmatrix} = \begin{bmatrix} 0 \\ T_1 \\ T_2 \\ \cdots \\ \cdots \\ T_{b-1} \end{bmatrix})$$

the operator $\Gamma[\bullet]$ is defined as:

$$\Gamma\begin{bmatrix}\gamma_0\\ \gamma_1\\ \gamma_2\\ \ldots\\ \ldots\\ \gamma_{b-1}\end{bmatrix}=\begin{bmatrix}f(\gamma_0)\\ f(\gamma_1)\\ f(\gamma_2)\\ \ldots\\ \ldots\\ f(\gamma_{b-1})\end{bmatrix}$$

where $f(\gamma_i)$ is +1 if $\gamma \geq 0$ else it is 0,

Y represents outputs of the first neural layer,

T are threshold values determined during a training phase,

w are weighting values determined during the training phase, and

b is the number of sets in the sequence.

38. (Amended) ~~An~~ The audio encoder ~~as claimed in~~ of claim 37, wherein the selection stage comprises selecting an output y_a of the first neural layer such that $y_a = 1$ and a is maximum for $i < a < b$.

39. (Amended) ~~An~~ The method ~~as claimed in~~ of claim 38, wherein the plurality of exponent coding strategies comprises strategies $S_1, S_2, \ldots, S_c$, where $c \leq b$, corresponding to respective differential coding limits 1, 2, … ,c.

40. (Amended) ~~A~~ The method ~~as claimed in~~ of claim 39, wherein the exponent coding strategy S_γ assigned for encoding exponents in said first set E_i is selected according to

$$\gamma = \max[\min(a+1, \sigma(E_i)), 1]$$

where $\sigma(E_i) = floor((\Sigma_j \| e_{i,j+1} - e_{i,j} \| / n) + 0.5)$.

211300_1.DOC